Benthic & Bacteria TMDL Development for the Rivanna River Basin

Scottsville Town Council Chambers

November 8, 2006
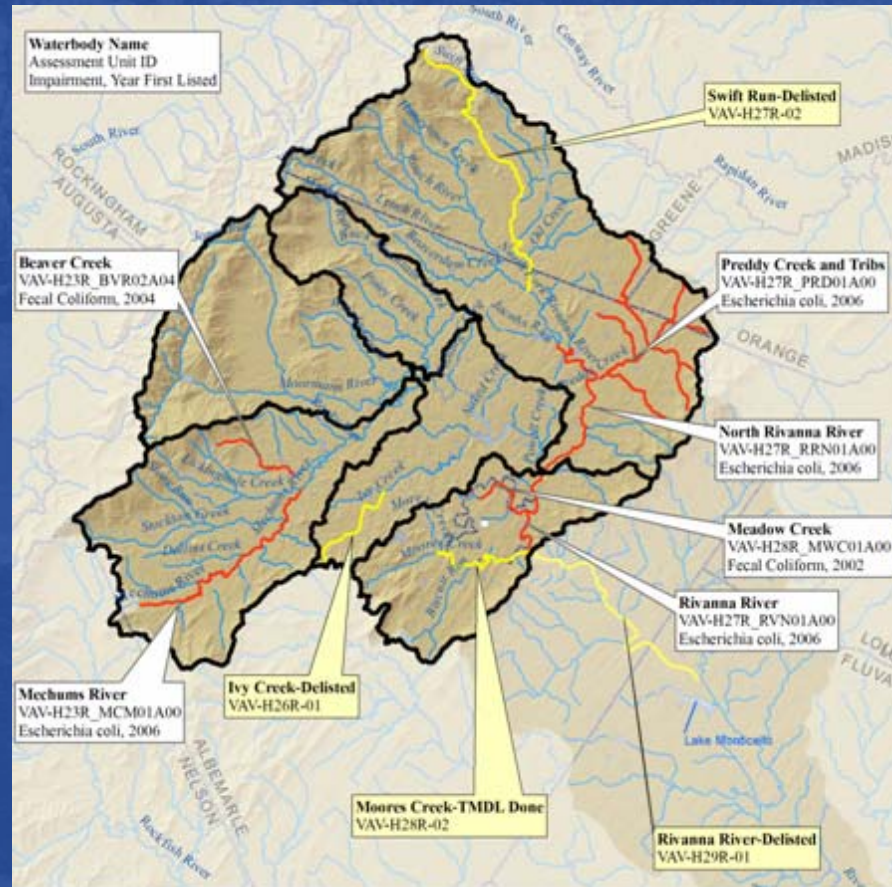
THE Louis Berger Group, INC.

Objective:

- **To present and review the <u>steps</u> and the <u>data</u> used in the development of bacteria and benthic TMDLs for listed segments in the Rivanna River Basin.**
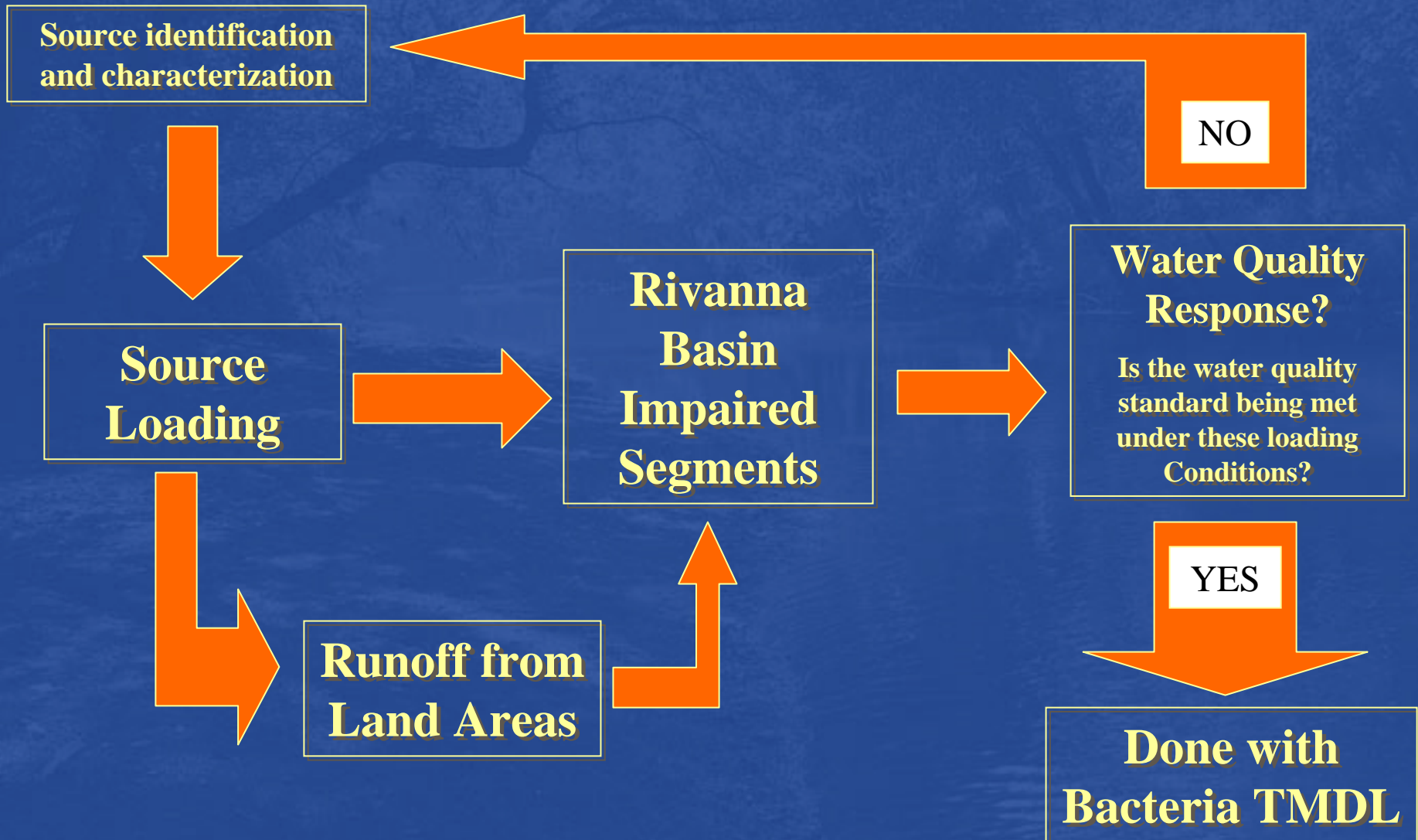
Bacteria TMDL Development

Bacteria Impairments

Watershed Id	Stream Name	Impairment (Initial Listing)	Length (Miles)	Source		
				NPS	Wildlife Other Than Waterfowl	Municipal (Urbanized High Density Area)
H23R	Beaver Creek	Fecal Coliform (2004)	4.8	✓	✓	
H28R	Meadow Creek	Fecal Coliform (2002)	4.01	✓	✓	✓
H29R	Rivanna River	E. coli (2006)	5.28	✓		
H27R	Preddy Creeks and Tributaries	E. coli (2006)	25.96	✓	✓	
H23R	Mechums River	E. coli (2006)	10.44	✓	✓	
H27R	North Rivanna River	E. coli (2006)	10.38	✓	✓	

Bacteria Water Quality Standards

- **Bacteria Impairment: the Primary Contact Recreation designated use is not met due to exceedances of the water quality criterion for bacteria**

- **A segment is listed as impaired if more than 10% of samples exceed the criteria**

- **As of January 15, 2003, E. coli is used as the indicator species instead of Fecal Coliform**

- **Virginia and EPA have agreed on a translator for TMDL model development**
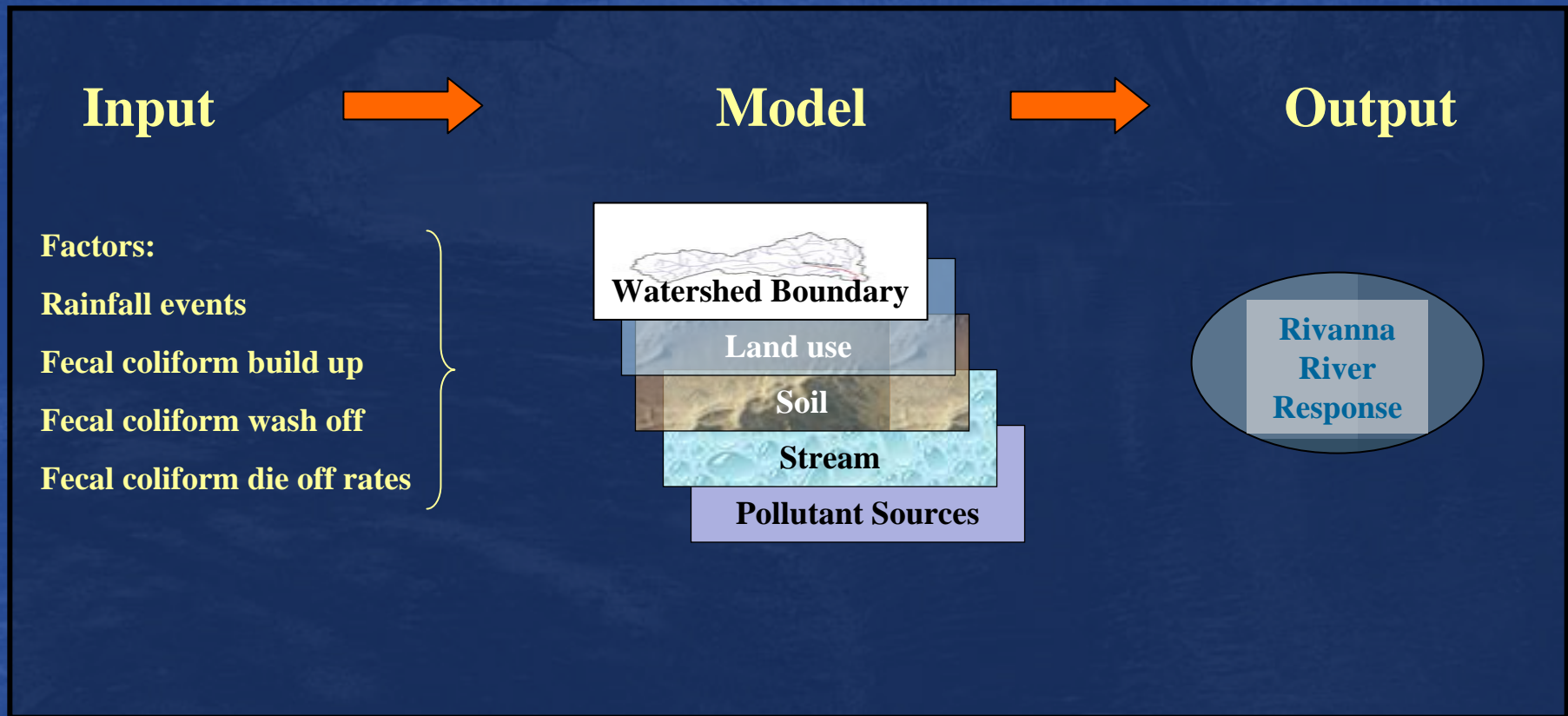
Bacteria TMDL Development

Source identification and characterization

Source Loading

Rivanna Basin Impaired Segments

Water Quality Response?

Is the water quality standard being met under these loading Conditions?

Runoff from Land Areas

NO

YES

Done with Bacteria TMDL

Water Quality Model

Hydrologic Simulation Program Fortran (HSPF)

➢ Hydrologic Model

➢ Watershed Model

➢ State of the art Modeling System

➢ EPA approved approach

HSPF Model

Linking Sources to Water Quality

Input ➡ **Model** ➡ **Output**

Factors:

Rainfall events

Fecal coliform build up

Fecal coliform wash off

Fecal coliform die off rates

Watershed Boundary

Land use
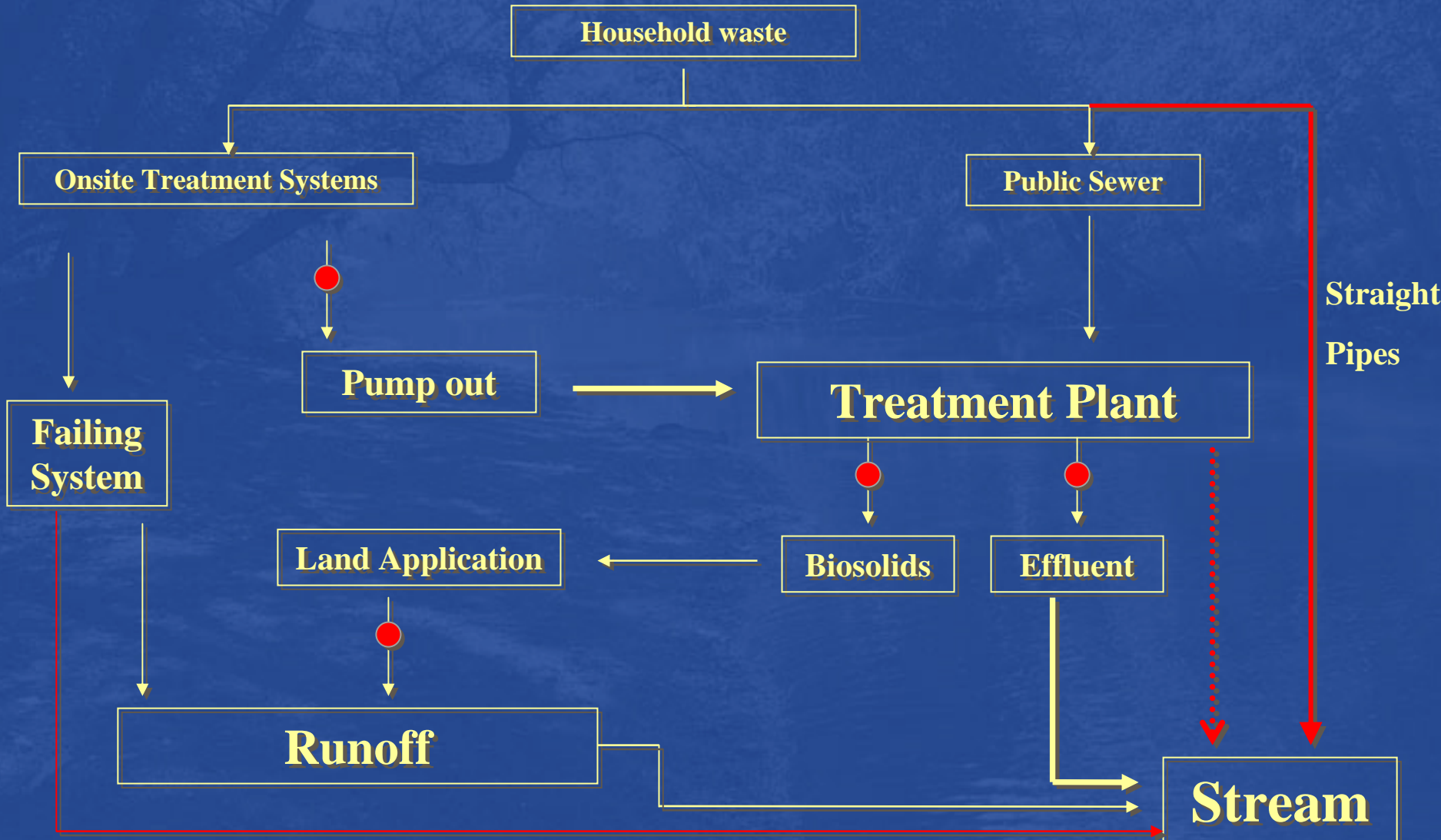
Soil

Stream

Pollutant Sources
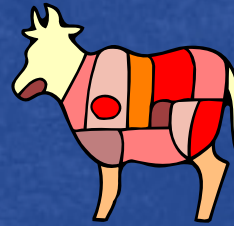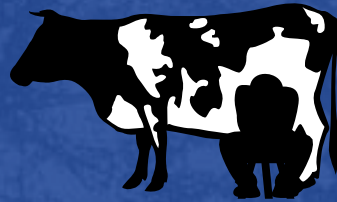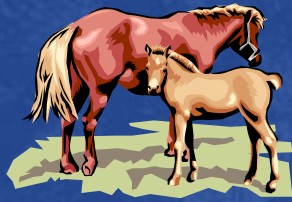
Rivanna River Response

Bacteria Sources Assessment

Addresses the following issues related to bacteria production:

- **Fecal Coliform loading from Human Sources**
  - Straight pipes
  - Septic systems
  - Biosolids

- **Fecal Coliform loading from Livestock**
  - Livestock inventory
  - Livestock grazing and stream access
  - Confined animal facilities
  - Manure management

- **Fecal coliform loading from Wildlife**
  - Wildlife Inventories

- **Fecal Coliform loading from Pets**
  - Pet Inventories

- **Best management practices (BMPs)**

Human Contribution

● **Fecal Coliform Decay**

Household waste

Onsite Treatment Systems

Public Sewer

Straight Pipes

Pump out

Treatment Plant

Failing System

Land Application

Biosolids

Effluent

Runoff

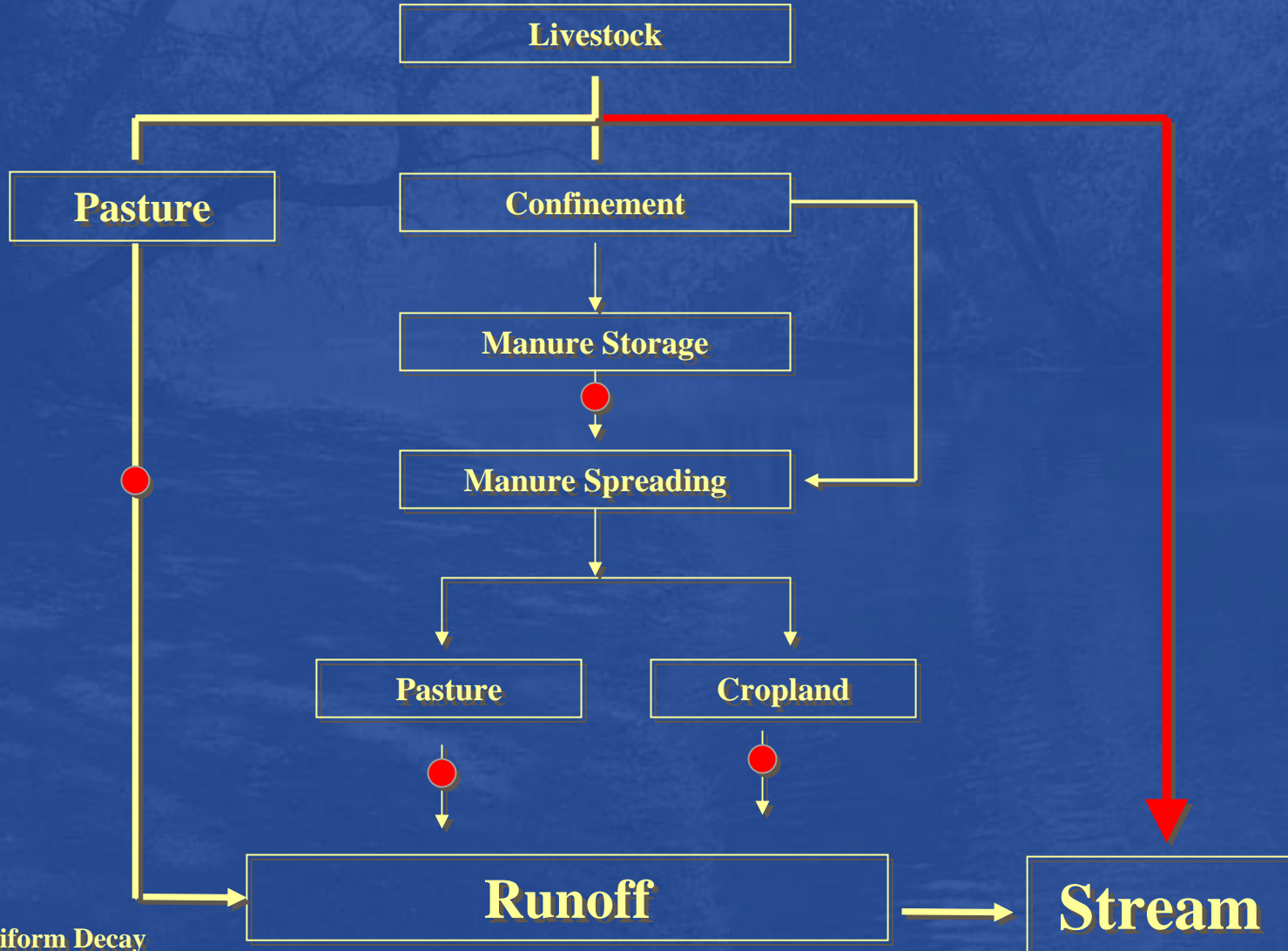**Stream**

Livestock

Pasture   Confinement

Manure Storage

Manure Spreading
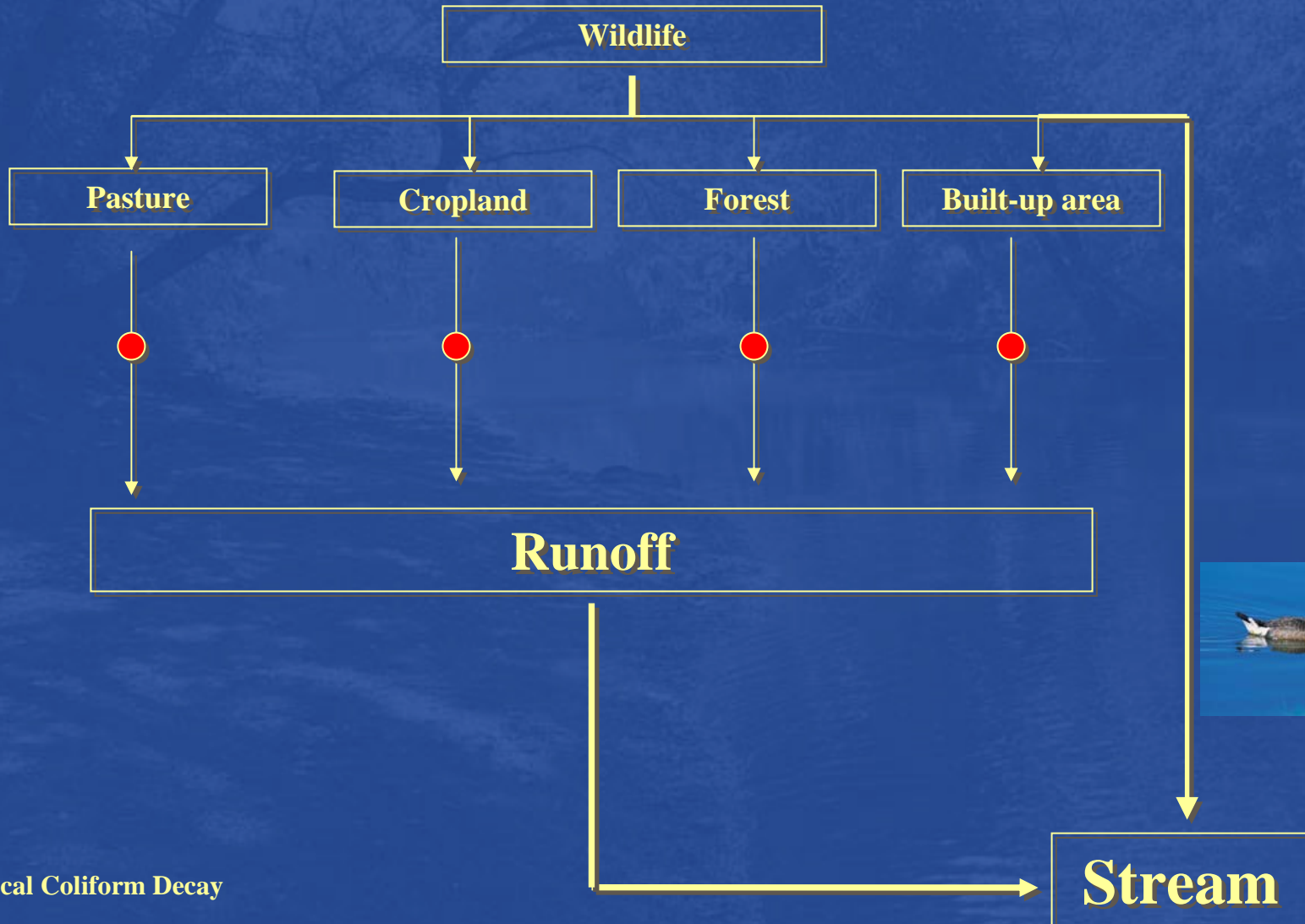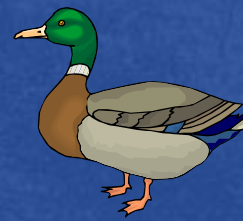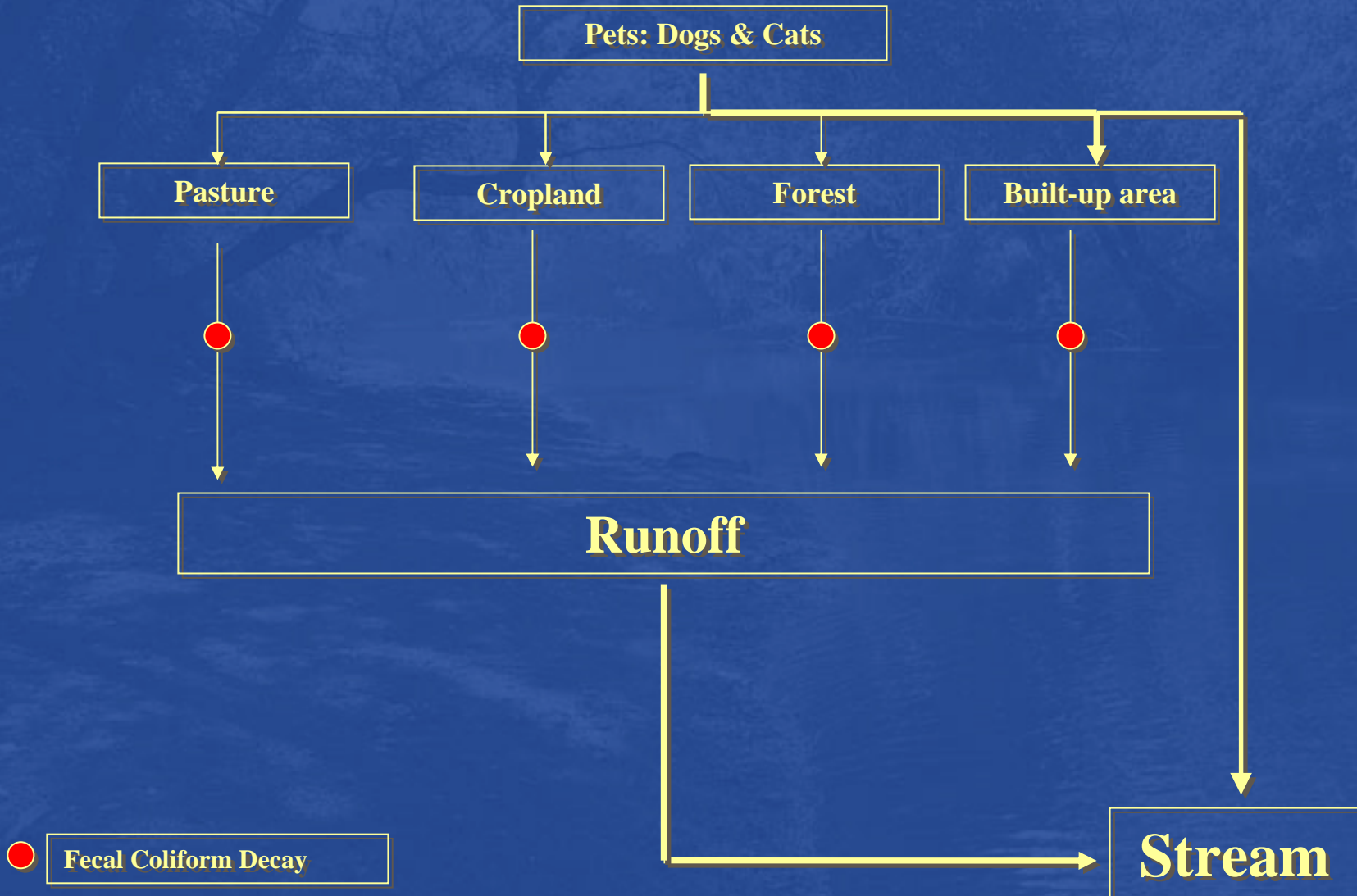
Pasture   Cropland

Runoff   Stream

● Fecal Coliform Decay

Source Loading Estimates

- **Determine the daily fecal coliform production by source**
- **Estimate the size/number of each source**
- **Determine whether the source is**
  - ➢ Direct Source
  - ➢ Indirect Source
- **Calculate the load to each land use based on a monthly schedule and for each source**
- **The sum of all the individual sources is the total load**
- **Source loading estimates used in HSPF model to simulate in-stream bacteria concentrations**

Benthic TMDL Development

Rivanna River Benthic Listed Segment

Rivanna River
VAV-H28R-01
General Standard (Benthic)
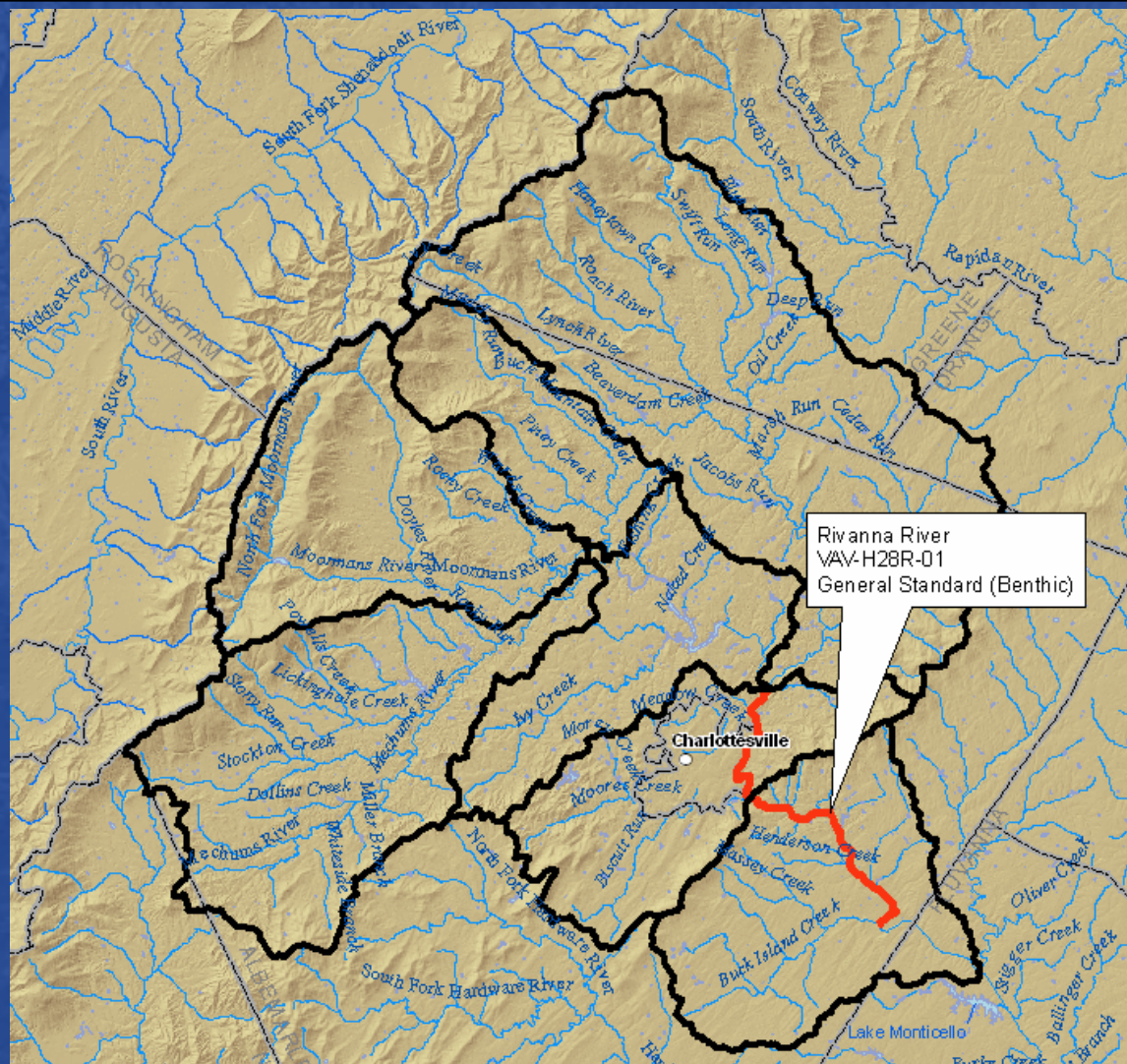
Watershed ID	Stream Name	Impairment	Sources	Length
H28R	Rivanna River	General Standard (Benthic) 1998	NPS, Urban	13.42- Miles

TMDL Process for Benthic Impairment

Stressor Identification
- Instream water quality
- Biological Monitoring

Stressor Sources
- Point Sources
- Nonpoint Sources

Rivanna River Basin

Loading

Reference Condition

End points

Stressor Load

Response?

Instream WQ

Benthic community

Benthic Stressor Identification

- **What pollutant(s) is causing the impairment of the benthic community?**
- **Common stressors include:**
    - Dissolved Oxygen
    - Nutrients
    - pH
    - Temperature
    - Sediment
    - Toxics

Data Used in Stressor Identification

1. **Water Quality Data**
    a) Instream water quality data

2. **Biological Assessment Data**
    a) Assessments performed since 1994
    b) Habitat assessments

3. **Toxicity Testing**
    a) Acute toxicity testing
    b) Chronic toxicity testing

4. **Discharge Monitoring Reports (DMR)**

5. **Field notes and observations**

Stressor Types Identified

- **Non-stressors:** The stressors with data indicating normal conditions and without water quality standard violations, or without any apparent impact

- **Possible stressors:** The stressors with data indicating possible links, however, with inconclusive data to show direct impact on the benthic community

- **Most probable stressors:** The stressors with the conclusive data linking them to the poorer benthic community.

Benthic TMDL Development

After the <u>most probable stressor</u> impacting biological community is identified:

- Biological reference condition established
    - Reference watershed approach
    - Endpoint identification

- Primary stressor pollutant modeled

- TMDL developed by determining load reductions need to achieve reference conditions

Data Needs

Data and Information Needs:

- **Watershed physiographic data**
- **Hydrographic data**
- **Weather data**
- **Point sources and direct discharge data and information**
- **Environmental monitoring data**
- **Stream flow data**
- **Bacteria sources assessment data**
- **Benthic stressor identification data**

Watershed physiographic data:

Type of Information	Data Source	Obtained	Processed/ Analyzed	Notes
Stream network	*Reach File Version 3 (US EPA BASINS) National Hydrography Data (USGS)*	Yes	Yes	
Land Use/ Land Cover data	*National Land Cover Data (NLCD) 1992*	Yes	Yes	
Soils	*USDA State Soil Geographic Database (STATSGO)*	Yes	Yes	
Digital Elevation Model (DEM)	*BASINS*	Yes	Yes	10-meter DEM resolution

Rivanna Land Use
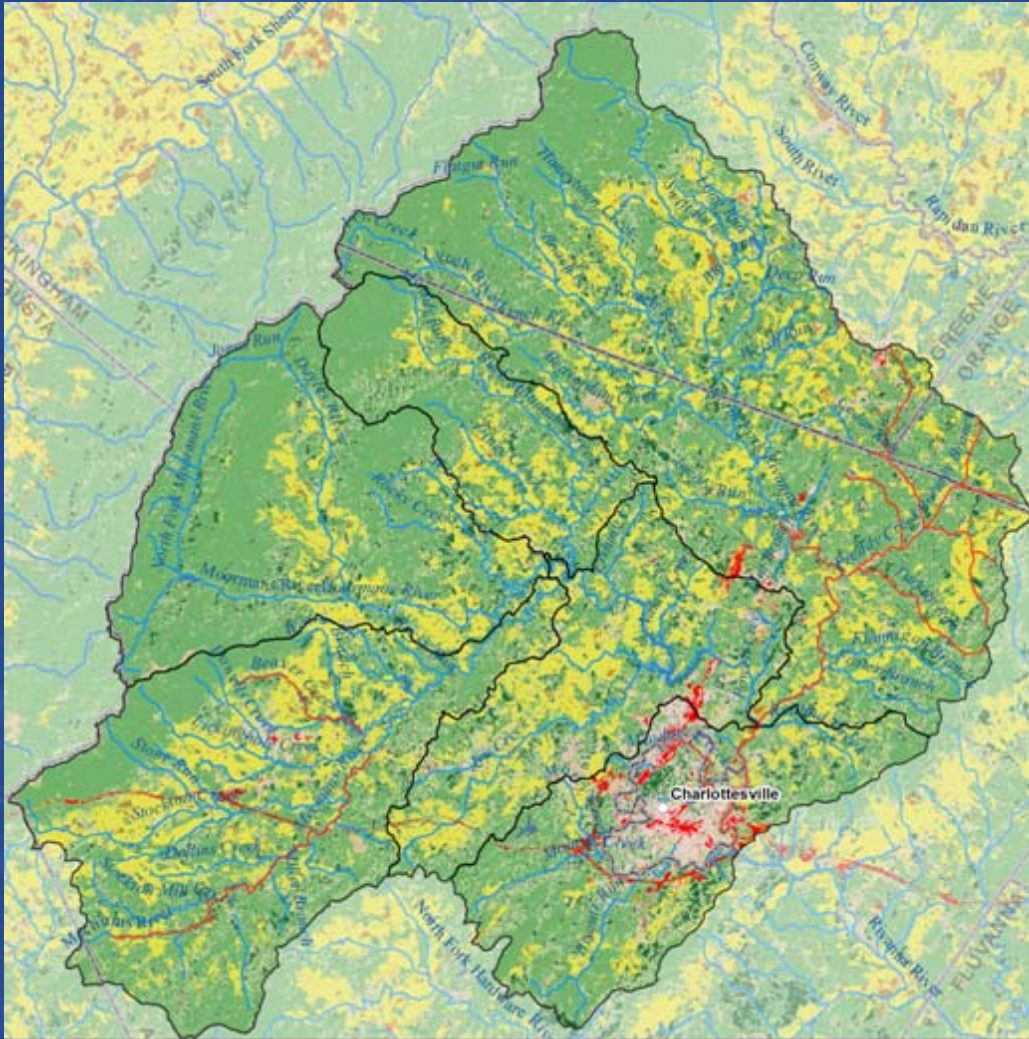
Dominate Land Use Types:

Forest: 72.7%

Agriculture: 22.0%

Rivanna Point Source Inventory

(VA Department of Environmental Quality)

Category	Permit Type	Count (Active or Application)
VPDES	Industrial	4
	Municipal	9
General Permits	Single Family Domestic Sewage	2
	Car Wash	1
	Concrete	3
	Construction Stormwater	48
	Industrial Stormwater	19
	Petroleum	3
	Mining	1
	VPA*	1
	Poultry	1
MS4 Permits	Individual MS4 Permits	5
Total		97

*Permits are issued for animal feeding operations with 300 or more animal units

Bacteria Sources Assessment data:

Type of Information	Data Source	Obtained	Processed/ Analyzed
Population/ Household/ Septic System Estimates	*U.S. Census Bureau*	Yes	In Progress
Livestock estimates/ agricultural practices	*USDA National Agricultural Statistics Service* *Soil and Water Conservation Districts* *Virginia Department of Health*	In Progress	In Progress
Wildlife estimates	*Virginia Department of Game and Inland Fisheries*	Yes	In Progress
Pet Estimates	*U.S. Census Bureau* *National pet estimates per household*	Yes	In Progress
Combined- sewer and stormwater outfall locations	*Virginia Department of Environmental Quality* *Local agencies*	Yes	In Progress
Active and historical industrial site locations	*Virginia Department of Environmental Quality* *Local agencies and stakeholders*	Yes	In Progress

Benthic Stressor Identification data:

Type of Information	Data Source	Obtained	Processed/ Analyzed	Notes
Macroinvertebrate monitoring data, RBPII, and Stream condition index scores	*Virginia Department of Environmental Quality* *Local agencies* *Universities* *Citizen monitoring groups*	In Progress	In Progress	Have received data from both VADEQ and StreamWatch
Water Quality Monitoring Data	*Virginia Department of Environmental Quality* *Local agencies and universities* *Citizen monitoring groups*	In Progress	In Progress	
Acute/Chronic Toxicity Study	*Virginia Department of Environmental Quality* *U.S. Environmental Protection Agency*	Yes	In Progress	
Facility Discharge Monitoring Reports	*Virginia Department of Environmental Quality* *Local agencies*	Yes	In Progress	

Next Steps

- **Identify data needs**

- **Collect available data**

- **Analyze data to investigate the bacteria and benthic impairments in the watershed**

- **Conduct biological stressor identification**

- **Develop bacteria source loading estimates**

- **Develop the modeling input parameters**

Local TMDL Contacts

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